NASA Scatterometer Projects: NSCAT and SeaWinds

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Satellite wind scatterometry is a microwave radar technique for the measurement of near-surface wind velocity (both speed and direction) over the global oceans. Scatterometer observations contribute to the measurement of wind stress, the understanding of the wind-driven ocean circulation, the monitoring and prediction weather, storms, and climate variation, and the generation of inputs to regional and global weather prediction models.

NASA has a long-term commitment to ocean wind remote sensing. The SEASAT-A Satellite Scatterometer (SASS) operated from June to October 1978, and demonstrated the potential of the scatterometer technique. Two Ku-band scatterometer systems will be launched and operated in the 1996-2002 time frame. The NASA Scatterometer (NSCAT) is currently in the final stage of spacecraft/instrument integration and test, and will be launched into a near-polar sun-synchronous orbit on the Japanese Advanced Earth Observing Satellite (ADEOS) in August, 1996. A follow-on instrument, SeaWinds, is in Phase C/D of development and is scheduled to launch on the ADEOS-2 spacecraft in February 1999.

The purpose of this paper is to present an overview of the NASA scatterometer program. The end-to-end system design, key system parameters, system performance, and science data products for both NSCAT and SeaWinds will be discussed. In addition, the current status and planned operational time line for each system will be presented.

Like its predecessor on the Seasat satellite, NSCAT employs multiple fan-beam antennas that radiate microwave pulses at 14 GHz. NSCAT's array of six, 10 foot long antennae will scan two 600 km bands of ocean, one band on each side of its orbital path. On-board Doppler processing is used to obtain uniformly spaced, 25 km ground resolution cells. The backscattered power will be measured by NSCAT and the normalized radar backscatter cross section (sigma-0) will then be calculated using the radar equation and calibrated radar parameters. The ground data processing system will produce wind products using an empirical geophysical model function. The data products will be distributed to the science community within two weeks of the receipt of raw data from ADEOS, with no backlog, throughout the mission. In addition, the capability to capture and generate near real-time wind data on an orbit-by-orbit basis for operational users is being developed.

The SeaWinds instrument is an advanced follow-on instrument to fly on the second Japanese Advanced Earth Observing Satellite (ADEOS-2'). SeaWinds will employ a conically scanning, "pencil beam" antenna. This design is more physically compact and thus more easily accomodated by the spacecraft. The SeaWinds measurement swath extends ±800 km on both sides of the ground track, yielding 90% ocean coverage in 24 hours. SeaWinds resolution is near 50 km, and wind retrieval accuracy is comparable to that of NSCAT over most of the measurement swath. The addition of a microwave radiometer (AMSR) on the ADEOS-2 platform greatly enhances the ability of SeaWinds to correct for atmospheric attenuation and to flag regions of rain corruption.

Suggested topic category: Observation Systems for Operational Oceanography: Scatterometry